

WHAT IS CLAIMED IS:

1. An electron beam apparatus comprising an electron source having an electron-emitting device, an electrode for controlling an electron beam emitted from said electron source, a target to be irradiated with an electron beam emitted from said electron source and a spacer arranged between said electron source and said electrode, characterized in that:

said spacer has a semiconductor film on the surface thereof that is electrically connected to said electron source and said electrode.

2. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said semiconductor film on the surface of said spacer is electrically connected to said wiring and said electrode.

3. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said spacer is arranged between said wiring and said electrode, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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4. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said spacer is a rectangularly parallelepipedic and arranged between said wiring and said electrode in such a way that the longitudinal direction thereof is in parallel with said wiring, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

5. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

6. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said spacer being arranged between said wiring and said electrode, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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electrically connected to at least one of said row-directed wirings or said column-directed wirings and to said electrode.

5           12. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said  
10 electrode is arranged on said target, said spacer being rectangularly parallelepipedic and arranged between at least one of said row-directed wirings or said column-directed wirings and said electrode in such a way that the longitudinal direction thereof is in  
15 parallel with said wirings, said semiconductor film on the surface of said spacer being electrically connected to at least one of said row-directed wirings or said column-directed wirings and to said electrode.

20           13. An electron beam apparatus according to any of claims 1 to 12, wherein said semiconductor film has a surface electric resistance between  $10^5$  [ $\Omega/\square$ ] and  $10^{12}$  [ $\Omega/\square$ ].

25           14. An electron beam apparatus according to any of claims 1 to 12, wherein a plurality of spacers are arranged.

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15. An electron beam apparatus according to any of claims 1 to 12, wherein said electrode accelerates electron beam emitted from said electron source.

5 16. An electron beam apparatus according to any of claims 1 to 12, wherein said electron-emitting device is a cold cathode device.

10 17. An electron beam apparatus according to any of claims 1 to 12, wherein said electron-emitting device has an electroconductive film including an electron-emitting region between a pair of electrodes.

15 18. An electron beam apparatus according to any of claims 1 to 12, wherein said electron-emitting device is a surface conduction electron-emitting device.

20 19. An electron beam apparatus comprising an electron source having an electron-emitting device, an electrode for controlling an electron beam emitted from said electron source, a target to be irradiated with an electron beam emitted from said electron source and a spacer arranged between said electron source and said electrode, characterized in that:

25 said spacer has a semiconductor film on the surface thereof that is electrically connected to said

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20. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said semiconductor film on the surface of said spacer is electrically connected to said wiring and said electrode.

22. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said spacer is a rectangularly parallelepipedic and arranged between said wiring and said electrode in such a way that the longitudinal direction thereof is in parallel with said wiring, said semiconductor film on the surface of said spacer being electrically connected to



23. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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20            25. An electron beam apparatus according to claim  
19, wherein said electron source includes a plurality  
of electron-emitting devices wired by wiring and said  
electrode is arranged on said target, said spacer being  
rectangularly parallelepipedic and arranged between  
25    said wiring and said electrode in such a way that the  
longitudinal direction thereof is in parallel with said  
wiring, said semiconductor film on the surface of said



being electrically connected to said electrode.

26. An electron beam apparatus according to claim 25, wherein said electron source includes a plurality of electron-emitting devices wired by a pair of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure, a conductive film on the surface of said electron-emitting devices is electrically connected to said row-directed wirings, and said column-directed wirings and said electron-emitting devices are arranged between said row-directed wirings and said conductive film on the surface of said electron-emitting devices, which is electrically connected to said row-directed wirings, and said column-directed wirings, whichever is closer to said electrode.

27. An electron beam apparatus according to claim 25, wherein said electron source includes a plurality of electron-emitting devices wired by a pair of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure, a conductive film is arranged between said row-directed wirings and said column-directed wirings and said electron-emitting devices, and said conductive film is electrically connected to said row-directed wirings, and said column-directed wirings, whichever is closer to said electrode.

28. An electron beam apparatus according to claim 25, wherein said electron source includes a plurality of electron-emitting devices wired by a pair of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure, a conductive film is arranged between said row-directed wirings and said column-directed wirings and said electron-emitting devices, and said conductive film is electrically connected to said row-directed wirings, and said column-directed wirings, whichever is closer to said electrode.

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29. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said electrode is arranged on said target, said semiconductor film on the surface of said spacer being electrically connected to said row-directed wirings or said column-directed wirings and said electrode.

30. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said electrode is arranged on said target, said spacer being

rectangularly parallelepipedic and arranged between  
said row-directed wirings or said column-directed  
wirings and said electrode in such a way that the  
longitudinal direction thereof is in parallel with said  
5 row-directed wirings or said column-directed wirings,  
whichever appropriate, said semiconductor film on the  
surface of said spacer being electrically connected to  
said row-directed wirings or said column-directed  
wirings, whichever appropriate, and said electrode.

31. An electron beam apparatus according to any  
of claims 19 to 30, wherein said abutting members of  
said spacer operate for both mechanically securing said  
spacer to said electron source and said electrode and  
15 electrically connecting the semiconductor film on said  
spacer to said electron source and said electrode.

32. An electron beam apparatus according to any  
of claims 19 to 30, wherein each of said abutting  
20 members of said spacer include a first member operating  
for mechanically securing said spacer to said electron  
source or said electrode and electrically connecting  
the semiconductor film on said spacer to said electron  
source or said electrode.

33. An electron beam apparatus according to any  
of claims 19 to 30, wherein said semiconductor film has

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a surface electric resistance between  $10^5$  [ $\Omega/\square$ ]  
and  $10^{12}$  [ $\Omega/\square$ ].

5 34. An electron beam apparatus according to any  
of claims 19 to 30, wherein a plurality of spacers are  
arranged.

10 35. An electron beam apparatus according to any  
of claims 19 to 30, wherein said electrode accelerates  
electron beam emitted from said electron source.

15 36. An electron beam apparatus according to any  
of claims 19 to 30, wherein said electron-emitting  
device is a cold cathode devices.

20 37. An electron beam apparatus according to any  
of claims 19 to 30, wherein said electron-emitting  
device has an electroconductive film including an  
electron-emitting region between a pair of electrodes.

25 38. An electron beam apparatus according to any  
of claims 19 to 30, wherein said electron-emitting  
device is a surface conduction electron-emitting  
device.

39. An electron beam apparatus comprising an  
electron source having an electron-emitting device, an

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electrode for controlling an electron beam emitted from said electron source and a target to be irradiated with an electron beam emitted from said electron source, characterized in that:

5           it further comprises a spacer arranged between at least two electrodes adapted to have respective electric potentials that are different from each other and said spacer has a semiconductor film on the surface thereof that is electrically connected to said  
10 electrodes and is provided with abutting members arranged at the abutments of said spacer and said electrodes.

40.   An electron beam apparatus according to claim  
15 39, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and one of said electrodes is said wiring.

41.   An electron beam apparatus according to claim  
20 39, wherein one of said electrodes is arranged on said target.

42.   An electron beam apparatus according to claim  
25 39, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and one of

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said electrodes is said row-directed wirings or said column-directed wirings.

43. An electron beam apparatus according to claim 5 39, wherein one of said electrode accelerates electron beam emitted from said electron source.

44. An electron beam apparatus according to any of claims 39 to 43, wherein said abutting members of 10 said spacer operate for both mechanically securing said spacer to said electrodes and electrically connecting the semiconductor film on said spacer to said electrodes.

45. An electron beam apparatus according to any of claims 39 to 43, wherein each of said abutting 15 members of said spacer include a first member operating for mechanically securing said spacer to one of said electrodes and electrically connecting the 20 semiconductor film on said spacer to one of said electrodes.

46. An electron beam apparatus according to any of claims 39 to 43, wherein said semiconductor film has 25 a surface electric resistance between  $10^5$  [ $\Omega/\square$ ] and  $10^{12}$  [ $\Omega/\square$ ].

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5            48. An electron beam apparatus according to any  
of claims 39 to 43, wherein said electron-emitting  
device is a cold cathode device.

15 50. An electron beam apparatus according to any of claims 39 to 43, wherein said electron-emitting device is a surface conduction electron-emitting device.

52. An electron beam apparatus according to claim  
19, wherein said apparatus is an image forming  
25 apparatus.

53. An electron beam apparatus according to claim



39, wherein said apparatus is an image forming apparatus.

5 54. An electron beam apparatus according to claim 1, wherein said spacer has a conductive film on the areas thereof abutting with said electron source and said electrode, said conductive film being electrically connected to said semiconductor film.

10 55. An electron beam apparatus according to claim 19, wherein said spacer has a conductive film on the areas thereof abutting with said electron source and said electrode, said conductive film being electrically connected to said semiconductor film.

15 56. An electron beam apparatus according to claim 39, wherein said spacer has a conductive film on the areas thereof abutting with said electrodes, said conductive film being electrically connected to said  
20 semiconductor film.

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